

The Female CTO

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In this enlightened time, most leaders recognize that women are capable of performing executive roles just as well as men. However, we find that men largely populate the position of the CTO. The degree to which men dominate this position is difficult to measure. In an attempt to quantify it we turned to the Google Image Search engine and executed a search for “Chief Technology Officer”. This returned over 4,000 images, many of them corporate mug shots of men and women wearing suits and serious expressions. We repeated this search multiple times spread over a period of several months. Interestingly, it returned a very similar album photos each time. More specifically for this chapter, it returned the same set of photos of women CTOs every time. Among the first 200 mug shots we found only eight that were women, and consistently the same eight. This method of identifying the ratio between male and female CTOs leaves a great deal to be desired from a scientific perspective. But, it does reveal that that female CTOs do exist, and are a small fraction of the CTO population. The search results indicate a ratio of 96% male to 4% female. The National Science Foundation reports that women form only 22% of the science and engineering workforce, though they are 42% of the overall workforce. It appears that the female CTO positions are far from the 22% female population in science and engineering.

Google’s Top Eight Female CTOs

- Dr. Lisa Bergman, CTO and co-Founder, Orielle Inc.
- Dr. Rita Schnipke, CTO, Blue Ridge Numerics Inc.
- Dawn Meyerriecks, CTO, Defense Information Systems Agency
- Mary Doyle, CTO and Vice President for Information Systems, Washington State University.
- Dr. Melody Mayberry-Stewart, CTO, City of Cleveland
- Rosalie Deane, CTO, Capital and Credit Merchant Bank
- Jane Janis, CTO, Information Institute of Syracuse
- Kristin Schnoebelen, CTO, D3 Inc.

As with all Google results, the eight female mug shots that appeared were accompanied by links to the web sites on which they resided. This provided a source of information on the identity, career, and background of these rare female CTOs, as well as a way to contact these women. In this chapter we will explore the careers of several of these female CTOs – their origins, responsibilities, and accomplishments.

Patterns of Eight Female CTOs

The nature of the organizations in which these women serve largely determines the definition of the CTO position. In previous publications we described the Five Patterns of the CTO. These patterns organize the most dominant responsibilities of CTOs in a

diverse set of corporations, government agencies, and other organizations. Research into the companies and careers of the CTOs we are profiling indicated which of these each patterns each person fit into. These patterns provide a useful structure and generic definition for each of the women profiled in this chapter (Figure 1). It is encouraging to see that the female CTOs are spread across all of the patterns and not stereotyped into a single role.

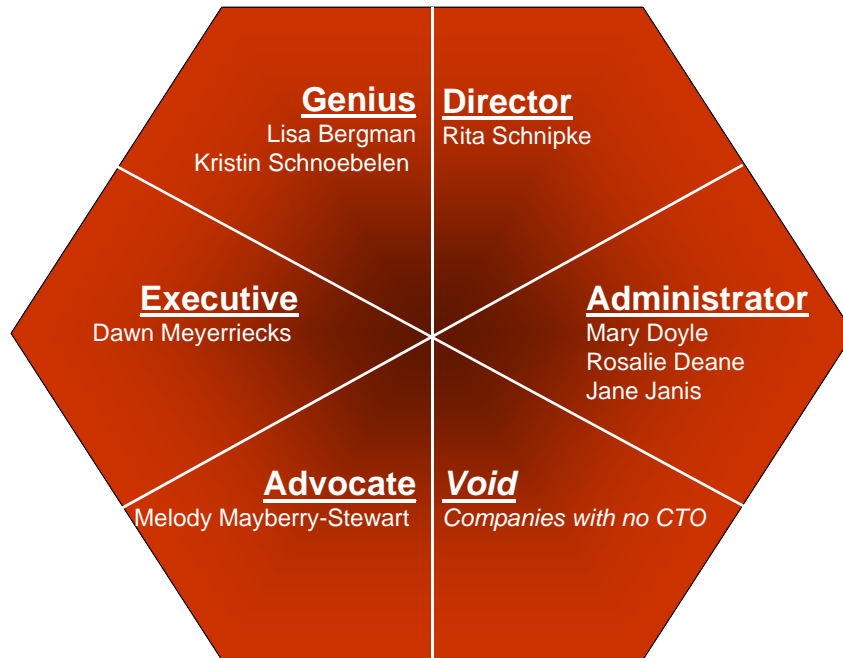


Figure 1. Patterns of Eight Female CTOs

Genius

The Genius Pattern describes a CTO who is the company’s expert in a specific technical field and is an active practitioner in or creator of new technology to support the company’s products and services. This CTO pattern is most often found in young start-up companies where one of the founders is the technical brain behind the operation. One famous example of this pattern is the partnership between Steve Jobs and Steve Wozniak in creating Apple Computer. Jobs was the master of marketing and sales, while Wozniak was the genius that created the computers.

Dr. Lisa Bergman is an excellent example of this pattern of CTO. She is a faculty member in the Physics Department of the University of Idaho and simultaneously serves as the CTO of start-up company Orielle. Peter Mills and Lisa Bergman started this company in 1999 in the Research Triangle of North Carolina. Their primary focus was in consulting services and research contracts for distributed computing, parallel algorithms, and data fusion. Mills’ experience at Duke University and Applied Research Associates provided the background that he needed to start a new company. He joined with Bergman, whose expertise is in the physical and materials science, to create a company that could expand beyond its software origins. Recognizing the need for differentiation

from hundreds of other software companies, Mills and Bergman are seeking to build a company that can offer research services in both the software and hardware domains.

Dr. Bergman's principle focus and contribution to the company is in the optical properties of semiconductors and quantum devices, as well as the photoluminescent spectroscopy necessary to image the fine details of these devices. This expertise allows Orielle to pursue small business innovative research (SBIR) contracts that are more complex than simply software applications. Many of today's mid-sized defense software and computer systems companies began in the same way and Orielle is hoping to duplicate their success with their combination of information systems and physical sciences expertise.

When Orielle bids on defense SBIR contracts, Dr. Bergman provides the technical expertise necessary for the principle investigator of such projects. Her extensive expertise in semiconductor physics, applied mathematics, and the programming of numerical methods allows the company to convince government agencies that they do have the expertise necessary to generate valuable research and new innovations that can be implemented in defense and civilian products.

Photoluminescent spectroscopy is an extremely specialized technology, but it is also a conduit into understanding and researching properties of semiconductors. This expertise may allow the company to dominate a very specialized technology niche. This niche will not support the growth of the next IBM or Intel, but it is an excellent way to create and establish a new small company. Orielle can build a reputation as the very best service provider in this field. This reputation can become the foundation for a strong and steady business, allowing the CTO to build relationships with government sponsors and partner companies. A reputation for successful innovation will allow Orielle to branch out into other adjacent fields and grow the base of expertise of the company. Mills has already expanded for specialized parallel computing software algorithms into the physical sciences, further movement into related fields in the growth trajectory for Orielle.

Becoming an expert in a small niche is also an excellent strategy for positioning the company for acquisition. Dominating a field can lock larger companies out of that niche. When that technology becomes an essential part of a major product or service, larger companies often become very interested in bringing that capability in-house. Companies like Intel, Google, Yahoo, Akamai, Lockheed Martin, Northrop Grumman, and hundreds of others are constantly purchasing smaller companies that can help them solve larger system problems. If Mills and Bergman are willing to position their company for acquisition, their mastery of complex software algorithms and photoluminescent spectroscopy will provide a path to personal wealth and perhaps a senior position in the acquiring company.

Lisa Bergman and Orielle are focusing on technical specialization as a strategy for growth and potential acquisition.

Director

The director pattern provides oversight and direction to a team of technologists, ensuring that the technology is aligned with the business vision. It emerged from the position of Director of R&D laboratories, which was the highest technical position within most companies up until the 1980's. These types of CTOs are often very technically competent and may have served in the role of the genius CTO at one time. However, the growth of the company often demands that they turn the hands-on technical work over to others to focus on broader leadership issues within the company and to promote the technical vision of the company.

Rita Schnipke's has had a rich career in the numerical analysis of data. She began as a scientist in the oil industry and moved into fluid flow and heat transfer software for industrial design and manufacturing. Her Ph.D. in mechanical and aerospace engineering certainly prepared her to serve as the genius CTO and a co-founder of Compuflow Inc. There she worked to develop computation fluid dynamics software for corporate R&D customers, hard-core scientists who specialized in CFD and provided their services to manufacturing divisions. Compuflow competed with all of the other major vendors in CFD software, providing scientific products on Unix workstations. Their success led to acquisition by ANSYS in 1992.

Computational fluid dynamics (CFD) software is used to analyze the performance of mechanical parts in automobile engines, spacecraft, and other machinery. Though most people may not be familiar with the term "CFD", the media has often used images from this software to illustrate the buildup of heat and stress on systems like the space shuttle. These familiar rainbow colored images provide a beautiful depiction of the laws of physics at work.

Rita Schnipke and her partner, Ed Williams, recognized that the engineering and product design world needed an accessible software package for performing CFD. Existing tools were targeted at R&D organizations that provided their services to the designers working in a manufacturing facility. These required extensive expertise and specialized computers to perform the analysis. This work was so expensive and time consuming that it was performed only on the finished designs for new parts and vehicles. This allowed the designers to modify the final design to avoid specific weaknesses, but it did not allow them to analyze dozens of prototype designs that were created much earlier in the process. Schnipke and Williams wanted to create a tool that this community could use themselves to explore the properties of all of their early design concepts. Accomplishing this required rethinking the fundamental assumptions of the CFD software industry. They needed a software package that did not require an expert to operate it and that could run on a much more common computer configuration. This vision led them to leave ANSYS to form Blue Ridge Numerics where they had "a clean piece of paper, a start-up budget, and a lot of passion".

Blue Ridge Numerics created a product that was very sophisticated, but where much of that sophistication was managed through default configurations for specific problems.

This meant that hundreds of individual variables would be set automatically, allowing a design engineer to create something himself, without having to call in a CFD specialist. The second unique feature of their software new was that it is operated on a PC using the Windows operating system. Most of their competitors required a high-end workstation using the Unix operating system. At that time such systems were priced ten times higher than comparable PCs and were not generally available to design engineers. These two unique decisions placed a very powerful tool in the hands of people who could use it right at the beginning of the design of a new engine part or rocket nozzle. That product, CFDesign, helped to create an entirely new market for CFD software and placed Blue Ridge Numerics at its forefront. NASCAR Teams now have access to usable CFD to analyze the aerodynamics of their racecars and the performance of their engines.

CFDesign has a user interface that serves both novices and experts. Similar to the philosophy behind Microsoft Word, CFDesign has common default settings for its most powerful capabilities. This means that a novice can use it by manipulating only a few easily understood variables. However, there is considerable power available to an expert who has the necessary years of experience to manipulate all of the settings in the software. Most consumer software products now follow this approach. The software industry has recognized that customers use the application as its own learning environment and do not have the luxury of being tutored in the tool by an outside expert. They have to be able to pick up the tool and start working. Williams and Schnipke broke with the accepted CFD industry practice of catering only to CFD experts.

Examining Blue Ridge's philosophy and behavior in serving customers, it is interesting to note that they follow four of Tom Peter's top 12 behaviors of "insanely great companies". First, they have great talent. Schnipke is a veteran in the industry who has retained her grasp on the technical side of the business and, as CTO, represents the company's commitment to continue excelling in CFD technology through the best talent it can hire. The company is based in Charlottesville, Virginia home of the University of Virginia, one of the leading research universities in the world. This is a city that is friendly to technology and business and creates a comfortable and attractive home to retain its graduates.

Second, Blue Ridge Numerics was willing to "disrespect tradition". The CFD software industry had traditionally developed products that were strictly for experts in the field. They maintained that CFD could not be understood or used without a graduate degree in the field and created software that focused on these very specialized people. This mindset extended to decisions to deploy their software only on scientific workstations and to avoid the more common PC Windows environment. Ed Williams and Rita Schnipke bucked this tradition and developed a software product specifically targeted at competent engineers that were still novices with CFD. They strove for a product that empowered these people to use CFD in the early design phases of a product. Bringing the tools down to the design engineers included deploying it on MS Windows.

Third, they were "totally passionate". They left executive positions in a larger company to pursue their vision of a new kind of fluid flow software. At the time, large industrial

companies were decentralizing their engineering work. They had previously routed all CFD work to a central R&D organization. R&D would perform the analysis to the designers in the manufacturing branches. However, the turn around on this analysis could be as long as six months, completing long after the product was already in production. Therefore, many companies were eager to find ways to place more responsibility into the hands of the manufacturing businesses and scale back their R&D groups. This created an entirely new customer base for CFD software – a base that Blue Ridge Numerics was created specifically to address.

This drastic change in the customer base did not follow the “normal industry behavior” at all. Violation of such behavior is Tom Peter’s fourth characteristic of success. Creating simplified software and deploying it on Windows PC’s was the technical requirement, but a passionate belief that industry behavior should change was the final ingredient. Williams and Schnipke worked with companies to show them how to empower heir design engineers to do their own CFD analysis using Blue Ridge Numerics’ CFDesign product.

Though argument and persuasive reasoning are one approach this, it is much more effective to get a few successes under your belt and let those show customers that there is a better way. A case study from Spalding sporting goods illustrates the value of “Upfront CFD” (Blue Ridge’s trademarked phrase for the process). Top-Flite, a leading brand of golf ball, was designed using Blue Ridge’s CFDesign software and their Upfront CFD process. Spalding had traditionally used CFDesign to analyze the behavior of finished balls in flight. But they discovered that the software could also be used in the early design process to select the depth and size of the dimples on the ball and to design-in specific behaviors. Deeper dimples caused the ball to fly lower in the air. Shallower dimples resulted in higher flight – up to a point. At some point the dimples became too shallow to interact with the air efficiently. At this point additional height comes at the cost of distance. Knowing this early in the process allowed Spalding to experiment with dozens of unique designs for the golf ball, identifying the best pattern to put into production. But, it also built an internal knowledge base that many other companies do not possess. Not only does Spalding know which designs are best, they also know which designs are not good and why they are not good. This knowledge has its own commercial value. They are now in a position to search out environments in which specialized types of performance are desired. This is very similar to the Post-it innovation, in which 3M scientists discovered glue that would not hold materials together permanently. Though not applicable to the main product lines, knowledge of this product allowed them to explore new products and create the extremely successful Post-it line.

Rita Schnipke spends a significant amount of time talking to customers, Blue Ridge’s engineers, and engineers from across the industry. Her primary goal as CTO is to “make sure that the technology is being driven toward the company’s goal of being a design tool, and not being led off course by the whims of the individual developers.”

Executive

The executive pattern provides corporate or organizational leadership that touches on all aspects of the product or service provided. It is usually found in large companies where the CTO works with the executive leaders on strategic directions, corporate vision, and the allocation of resources toward future capabilities.

Dawn Meyerriecks is the CTO for the Defense Information Systems Agency (DISA). This agency is responsible for the command and control computers throughout the military. It develops global networks that allow military personnel worldwide to share information that is essential to conducting their missions. As the CTO, she works with everyone in the 1,200-person organization to insure that they are taking advantage of the right technologies and getting these fielded efficiently. This includes encryption, biometrics, and wireless technology to support classified systems and operations.

After earning a degree in Electrical Engineering at Carnegie Mellon University, she joined defense contractor TRW, then moved to the Jet Propulsion laboratories, and finally to DISA. Her education and career in technology began in the late 1970's when women in engineering and computer science were rare. However, over the years she says this has changed and DISA now has women throughout its ranks.

Though working as a computer programmer was extremely rewarding and enjoyable, Meyerriecks' climb to the CTO position required that she "give up the keyboard" and focus more on working with people. Today her effectiveness is measured by her ability to get large numbers of people working together toward a common goal. This can be extremely difficult within the Department of Defense where individual services - the Army, Navy, Air Force, and Marine Corps - can all behave as fiefdoms that refuse to cooperate. The Defense Information System Agency must create common computing and communications solutions that bridge these service boundaries and enable these groups to work together on the battlefield in spite of their differences. To accomplish this, Meyerriecks models her leadership style on that of her predecessor, former Technical Director Frank Perry, who is now CTO with the Department of Veterans Affairs. "I learned don't ever let anybody know they're getting to you," she says. "If you can maintain calm when everyone around you is angry or frightened, they will look to you." She recognizes that her leverage comes from reason, dependability, and openness to listening to everyone's concerns. A CTO who can do this effectively is much more valuable to the organization than someone who attempts to impose standards by edict, without discussion and consideration. In this respect, Dawn Meyerriecks has made a huge jump in her ability to powerfully influence the development of military information systems.

Meyerriecks wrestles with both technical and cultural challenges within DISA and DoD. Technically she is searching for new techniques to allow DoD to achieve interoperability across many families of communications and computing systems. Achieving this requires bringing service sponsors to standards that are not service-specific or even DoD specific. She must get the military to adopt commercial standards because commercial

applications now move forward much faster than do DoD solutions. Therefore, the military finds itself using commercial tools that operate on commercial standards.

Her office is also tackling the issue of managed identity and access control. Tens of thousands of military personnel access thousands of computer systems and networks every day. Each person has approval to access a different set of systems and the need to know limited sets of data. Establishing a practical system of identity verification that can be used in the field by people at all levels of technical expertise is a major challenge. To assist DISA with these issues, Meyerriecks' office has published a list of the major technical challenges that they face and would like industry help with. Providing this type of direction and solicitation is an important part of the partnership that DISA has built with commercial vendors like Microsoft, IBM, Oracle, and Verisign.

DISA's challenges are not just technical - they are also cultural. As described above, they are struggling to get all of the communities within the Department of Defense to accept common solutions to problems, commercial standards, intellectual property from other services, and market forces. This is a very different approach to the tradition of relying on government policy for all decisions. These types of issues must often be tackled hand-in-hand with the technical issues. It is often impossible to separate things like commercial standards from the policies and historical precedents for opposing such standards that have built up within the organization over decades. To some degree "commonality" across the Army, Navy, and Air Force diminishes the independence, unique identity, and tradition of these groups. DISA and Meyerriecks must build cooperation, commonality, and standardization within computer and communication systems without diminishing the spirit of uniqueness that is cherished by each military branch.

Finally, Meyerriecks is trying to implement the IT side of the military's conversion to "Network-centric Warfare". Her office has expressed this as a change from "command and control" to "command and coordination". DoD and DISA recognize that computer systems and modern weapons allow people to operate more independently and to be more effective. Therefore, they are attempting to replace some of the "control" that has been typical of military operations with "coordination". We can no longer control everything that happens in a military operation. Our modern systems allow us to release some of that control to automated systems and empowered leaders. The goal then becomes to coordinate their actions toward the overall mission. This is very different from the traditional doctrine of control and subordination. Groups like the Army Rangers, Navy SEALs, and Marine Expeditionary Forces blazed the trail on coordination of individual initiative and decision-making. The modern political situation calls for the employment of more forces of this type and fewer of the mechanized armies of World War II. Therefore, this culture and the weapons to empower it are propagating throughout the military.

Administrator

The administrator CTO is responsible for controlling budgets, identifying departmental synergies, and negotiations with vendors that provide information systems and technology-based products.

Washington State University's CTO and Vice President for Information Systems, Mary Doyle, finds herself focused on the strategic plan to deploy information technology throughout the organization. She is "responsible for leading the policy, planning, development, deployment, operation, and maintenance of resources comprising the institution's core technology infrastructure." This infrastructure includes campus networks, central administrative systems, university file and mail services, technology in university classrooms, the interactive television system for distance education, public broadcasting, and centrally provided technology support services. In concert with the President, Vice Presidents, Deans, and the University Advisory Committee for Computing and Telecommunications, Doyle plans and sets the direction for all matters involving information technology across the institution.

Dr. Doyle has also been appointed the Interim Director of Libraries at WSU. In this situation, the university recognizes that there is a fundamental relationship between IT and the libraries. "Both units are in the information business and the coordination of this information infrastructure ... is increasingly critical." There are communities that argue that all libraries should and will become digital archives in the future. There are also those who argue that books and printed documents are historical artifacts in themselves, carrying much more value than just the information printed on the page. Doyle's strategic task is to identify the best ways to apply IT to library resources. She must satisfy the need for rapid and remote access to information that currently resides primarily on the printed page. But she must also preserve the historical value of the rare and unique printed materials within the library's archives.

In the university environment, these types of policy decisions will require collaboration with the university President and multiple Deans. She must also deal with representatives from the state university system, state government, and student organizations advocating both sides of the issue.

"Our faculty, students and staff rely on technology for an increasing number of things they do every day and the possibilities for the future are astounding. Advances in network technology, wireless technologies, advances in fiber optics and multi-media communications continue to change the way we work, study and play," Doyle said. "At the same time, we see an increased need for more serious attention to security, appropriate use and copyright issues."

Like the Department of Defense, libraries and universities are concerned about issues with security of data and systems, identity verification, and appropriate use of and access to information. As a CTO, Doyle can benefit from the significant investments that organizations like DISA are putting into these areas. Remaining abreast of the

commercial availability of these technologies and the power that they possess is a significant part of her administrative CTO role.

Advocate

The advocate pattern CTO represents the needs of the customer. This person often emerges from departments that were focused on the customer interface. Their perspective is not that of technology development, but more inclined toward the customer interface. Service organizations like Federal Express and government offices typically fall into this pattern.

Dr. Melodie Mayberry-Stewart, Chief Technology Officer for the City of Cleveland, is responsible for developing, implementing and supporting Information Technology (IT) strategies to improve government services for the City. Her challenge is to produce an IT-savvy government that uses the latest technology to be “operational, efficient, and effective”.

A native Clevelander, Chief Mayberry-Stewart is the founder and CEO of the Black Diamond IT Consulting Group. She has more than 25 years of IT experience and works with CEOs, COOs and CIOs to develop IT strategy and build high-performance IT organizations to improve organizational performance. She was the first African American female General Manager and Vice President of Corporate and Shared Services for worldwide delivery of IT systems and operations for the BP Amoco Corporation, where she had global responsibility for the design and implementation of IT systems and services. Prior to joining BP Amoco, Mayberry-Stewart was the first and only Black female Chief Information Officer (CIO) in the health care industry in the country. She was the CIO at Beth Israel Medical Center, with headquarters in New York City with more than \$1 billion in revenues annually.

The City of Cleveland relies on Mayberry-Stewart to lead efforts to modernize its information infrastructure. The old infrastructure evolved as a number of disparate and incompatible systems. Through competitive contracting, the city has selected SBS Communications to design and deploy a new system that ties together all of the city services and makes them more accessible to the citizens.

Mayberry-Stewart inherited a city that had very poor technology penetration. Only 25% of city employees had access to email, governmental IT positions were staffed with minimally qualified individuals, and IT positions carried sub-standard pay levels making it difficult to attract highly qualified candidates. She has been working with the city's Director of Finance to access the financial resources needed to fix this situation. However, she recognizes that technology systems must compete with other departments for the same limited pool of resources. They are constantly balancing purchases between new police cars, construction new of water processing plants, and upgrades to the IT infrastructure. She presents cities like Honolulu, Chicago, and Seattle as models for the capabilities she is targeting. One of her most important missions is working with city

council to educate them to the economic and social benefits of IT, and hopefully winning their support.

Case Western Reserve University has led the creation the OneCleveland organization to bring together non-profit and government agencies that can build a communications infrastructure within the city. Their goal is to promote education, training, cultural events, and access to government services for the population of Cleveland. This network will support the needs of schools, museums, hospitals, police and fire departments, and government offices to access high-speed networks for better internal operations and service to citizens. Through OneCleveland's efforts, each of these organizations will not have to build or purchase their own backbone infrastructure between their facilities, but will be able to leverage a common backbone supporting all city services. Mayberry-Stewart represents the interests of the City of Cleveland within this group and provides expertise and insight into the needs of the city and the local government's plans to meet those needs.

Conclusion

This chapter explored the careers and responsibilities of several female CTOs. Throughout this research we could find no differences between these women and their male counterparts. The women spanned all five of the major patterns of the CTO position, possessed similarly impressive backgrounds, and led successful organizations from start-ups to industry leaders. They emphasize the need to represent technology at the executive level of an organization. In business, technology decisions have a major impact on the company's ability to compete in the future. In government, it provides significant advantages on the battlefield and in services to local citizens. In the public sector, technology has a strong impact on the educational opportunities that are available in a university. Technology has become an important part of most products and services. Therefore, the strategic management of it is a core part of a company's success.

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